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Nanostructured Fe-MOF-5-wood for scalable H2O2 production

Abstract:

Energy crisis and environmental issues are attracting increasingly attention in the world due to the excessive consumption of non-renewable fossil energy and resources. Compared to the typical renewable solar energy, mechanical energy, wind energy, and hydrogen energy, hygroelectric and thermoelectric energy harvested respectively from natural water molecular (moisture) and waste heat in ambient air is particularly attractive owing to its cost-effectivity, ubiquity, easy accessibility and less environmental requirements without any climate and geographical limitation, could enable promising direct conversion of hygro-thermoelectricity for power cable-free IoT and self-powered systems. By inspiring the water, ion uptake from tree, the hypothesis is it allows us to develop solid ionic woods and its device to collect sustainable hygroelectricity, thermoelectricity from ambient air and also can modulate electrochemical reactions for bifunctionally decomposing aqueous and gaseous organic pollutants, by taking advantages of the unique nature-made porous and top-down microchannels within wood. Here we fabricate the emerging solid ionic woods processed directly from natural wood using various cost-effective strategies to form continuous nanostructures with ion charges like spider webs around the inner walls of the retained intact top-down wood microchannels. The connected device system consisting of only several components can generate a voltage up to useful volts and currents to power typical lights. Moreover, we also report another solid ionic wood to establish a simple and cost-effective solid electrochemical strategy for the cathodic giant production of H2O2 and hydroxyl radicals (OH•) that can continuously degrade the organic pollutants either in gaseous or aqueous state. Our technology directly utilizes the ubiquitous water, wood and air in nature to develop sufficiently work for Advanced oxidation process (AOPs). We feel that the emerging solid ionic woods show huge promise for ambient air-energy conversion and AOPs to develop the next self-sustained system, with a low-cost, sustainability and easily larger scale-up.

Biography

Liu Detao is a prominent researcher based at the School of Light Industry and Engineering at South China University of Technology, China. Driven by a passion for addressing pressing global challenges such as energy scarcity and environmental degradation, Liu's research focuses on developing innovative solutions at the intersection of renewable energy and environmental sustainability. With a keen understanding of the urgency posed by the overreliance on non-renewable fossil fuels and the resultant environmental consequences, Liu's work has centered on harnessing alternative energy sources, particularly hygroelectric and thermoelectric energy. Recognizing the vast potential of these forms of energy, which derive from natural water molecules (moisture) and waste heat in ambient air, Liu aims to leverage their cost-effectiveness, accessibility, and minimal environmental impact to power cable-free Internet of Things (IoT) devices and self-powered systems.